ABSTRACT

An acoustic tranducer is in contact with a wall that has a much different acoustic impedance than a fluid. The transducer transmits an acoustic pulse into into the wall (such as a plate, a wall of a tube or a wall of a sample chamber) that is in contact with this fluid. As the acoustic pulse bounces back and forth within this "near wall", each echo of this original pulse loses the same fraction of energy on each round trip so the echo energy decays exponentially. Knowing the acoustic impedance of the wall material and the reflection intensity at the transducer/wall interface (which is obtained when using air as the fluid), it is possible to calculate the acoustic impedance of an unknown fluid from the slope of a plot of the logarithm of echo energy versus echo number.

A fluid's density equals its acoustic impedance divided by its sound speed. To measure the unknown fluid's sound speed, another acoustic reflector (a "far wall") is placed at some known distance from the near wall and the round trip travel time is measured. When the near wall is part of a sample chamber, this other acoustic reflector can simply be the inner face (the face in contact with the fluid) of the opposite wall of the chamber.